Menzie-Cura & Associates, Inc.
One Courthouse Lane
Suite 2
Chelmsford, Massachusetts 01824
Telephone (978) 453-4300
Fax (978) 453-7260

MEMORANDUM

Date: February 17, 2000
File: 521
To: Chip Crocetti
From: Donna Vorhees and Cheri Butler
cc: Jim DiLorenzo, Wayne Ives, Margaret McDonough, Phil Trowbridge
Subject: Beede Waste Oil/Cash Energy Site, Plaistow, NH
REVISED preliminary remediation goals (PRGs) for soil and groundwater

Menzie-Cura & Associates, Inc. revised the preliminary remediation goals (PRGs) for soil and groundwater based on comments made at the team meeting on January 7, 2000. Section I below describes the general approach and presents equations used to calculate PRGs. Sections II and III summarize the modifications we made and the revised PRGs. Section IV discusses PCB cancer risk in more detail and Section V presents conclusions.

I. Calculation of Preliminary Remediation Goals

Draft preliminary remediation goals (PRGs) were calculated following consultation of applicable state and regional policy. This memorandum presents draft PRGs for soil and groundwater that prevent unacceptable risk to human health. The ecological risk assessment for the Site suggests that soil and groundwater do not pose a population-level risk to ecological receptors. Therefore, PRGs based on human health risk alone are adequate. Surface water and sediment PRGs are likely to be dictated by possible ecological risk at the Site and will be considered when the ecological assessment is complete.

Exposure Scenario and Pathways

The PRGs are based on the future resident scenario, which represents the most intensive exposure that is likely to occur at the Site. The PRGs account for cumulative cancer risk (risk) and non-cancer hazard (hazard) across the following exposure pathways:

- Soil ingestion
- Dermal exposure to soil

- Groundwater ingestion
- Dermal exposure to groundwater
- Inhalation of vapors from groundwater (assumed to be equal to risk associated with the groundwater ingestion pathway per USEPA Region 1 Risk Update, 1995)

The PRGs do not account for possible exposure via the following pathways:

- Soil vapors (outdoor exposure)
- Fugitive dust
- Soil contaminant uptake/deposition on home garden produce
- Vapor intrusion from groundwater and/or soil into homes
- Future leaching of VOCs from soil to groundwater (only a few VOCs screened in as soil COPCs based on direct exposure because most elevated VOC concentrations were detected at depths greater than ten feet)

We estimated negligible levels of non-cancer hazard and cancer risk associated with inhalation of soil vapors and fugitive dust. A great deal of uncertainty is associated with estimating plant uptake of Site contaminants. We did not quantify risk associated with this indirect exposure pathway. While vapor intrusion is possible in some homes, the risk from this pathway is likely to be small relative to the direct groundwater and soil exposure pathways. Also, the soil and groundwater remediation needed to attain PRGs should reduce concentrations to levels that should not pose a vapor intrusion risk. Uncertainties arising from exclusion of these pathways from PRG calculations is described in greater detail in the draft human health baseline risk assessment.

Draft PRGs are presented for COPCs for which the individual cancer risk exceeds 1E-6 or the hazard quotient is greater than 1 (i.e., "risk drivers"). VOCs were infrequently detected in soil at depths less than ten feet, and few were screened in as soil COPCs. Those that screened in were not "risk drivers." However, Sanborn, Head & Associates, Inc. (SHA) developed cleanup goals for VOCs in soil that are intended to limit leaching to groundwater. Therefore, this memorandum does not present PRGs for this indirect exposure pathway.

The PRG for lead in soil is based on the US EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model. The PRG of 400 mg/kg is the US EPA recommended cleanup goal for a residential land use (US EPA, July 14, 1994 – Revised Interim Soil Lead Guidance for CERCLA sites and RCRA Corrective Action Facilities).

Target Non-Cancer Hazard Index and Cancer Risk

New Hampshire guidance recommends that cumulative non-cancer hazard and cancer risk across all contaminants of potential concern (COPCs) and the 5 residential exposure pathways should not exceed 1 and 1E-05, respectively. Given the number and toxicity of COPCs, we calculated low, and sometimes unattainable (i.e. they exceed typical background concentrations and analytical detection limits), PRGs.

PRGs based on non-cancer hazard can also be calculated after dividing COPCs according to target organ/system for toxicity. These PRGs are not presented in this memorandum or associated tables. However, this approach would lead to higher PRGs because one assumes that non-cancer hazard is additive only across COPCs that affect the same target organ/system rather than being additive across all COPCs, regardless of target organ/system.

Note that there is no single solution to PRG calculations because "acceptable" levels of risk can be apportioned among COPCs and contaminated media in many ways. Draft PRGs are presented in three ways:

1. New Hampshire target hazard and risk is apportioned equally across all COPCs and the five residential exposure pathways for both media. With this approach, cumulative hazard and risk at the Site is 1 and 1E-05, respectively.
2. Option 1 is followed, except that PRGs suggested by SHA are substituted for a subset of COPCs. With this approach, cumulative hazard and risk at the Site is 1 and 1E-05.
3. New Hampshire target hazard and risk is apportioned equally across all COPCs within each medium. With this approach, cumulative hazard and risk across both media at the Site is 2 and 2E-05, respectively.

Equations for Calculating PRGs

Non-cancer PRGs
We calculated PRGs for non-cancer hazards to a future resident. Using RME exposure assumptions, we calculated separate PRGs for a future adult resident and for a future child resident. We used the following equations to calculate non-cancer PRGs for the future resident exposure scenario:

For soil:

$$Cs = \frac{THI * BW * AT}{EF * ED * \left[\left(\frac{1}{RfD_{oral}} * IR * CF * AF \right) + \left(\frac{1}{RfD_{dermal}} * SA * SAF * CF * ABS \right) \right]}$$

C_S	= Concentration in soil corresponding to the target hazard index.
THI	= Target hazard index.
BW	= Body weight (kg)
AT	= Averaging time (days)
EF	= Exposure frequency (days/year)
ED	= Exposure duration (years)
RfD_{oral}	= Oral reference dose (mg/kg-day)
IR	= Soil ingestion rate (mg/day)
AF	= Soil ingestion absorption factor (unitless)
RfD_{dermal}	= Dermal reference dose (mg/kg-day)
SA	= Skin surface area (cm^2)
SAF	= Soil adherence factor (mg/cm^2)

CF = Conversion factor ($1E^{-6}$ kg/mg)
ABS = Dermal absorption factor for soil (unitless)

For groundwater:

$$C_{GW} = \frac{THI * BW * AT}{EF * ED * \left[2^{a} * \left(\frac{1}{RfD_{oral}} * IR * AF\right) + \left(\frac{1}{RfD_{dermal}} * SA * ET * CF * ABS\right)\right]}$$

C_{GW} = Concentration in groundwater corresponding to the target hazard index.
THI = Target hazard index.
BW = Body weight (kg)
AT = Averaging time (days)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
RfD_{oral} = Oral reference dose (mg/kg-day)
IR = Water ingestion rate (L/day)
AF = Water ingestion absorption factor (unitless)
RfD_{dermal} = Dermal reference dose (mg/kg-day)
SA = Skin surface area (cm^2)
ET = Exposure time (hours/day)
CF = Conversion factor ($1E^{-3}$ L/cm^3)
ABS = Permeability coefficient (cm/hr)
[a]The water ingestion term is multiplied by two for volatiles only to account for indoor residential exposure via vapor inhalation from tapwater.

Cancer PRGs
We calculated PRGs for cancer risk to a future resident. Using RME exposure assumptions, we calculated a PRG that combined the risk for an adult and a child future resident. We used the following equations to calculate cancer PRGs for the future resident exposure scenario:

For soil:

$$C_S = \frac{CR * AT_c * 10^6\ mg/kg}{F * CSF * \left[IF_{soiladj} + \left(SFS_{soiladj} * (ABS_d / ABS_{eff})\right)\right]}$$

C_S = Concentration in soil corresponding to a cancer risk level of 1×10^{-6}
CR = Target cancer risk level of 1×10^{-6}
AT_c = Averaging time
F = Exposure frequency (days/year)
CSF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$
$IF_{soiladj}$ = Ingestion rate, adjusted for ages 1-6 and adults (mg-yr/kg-day) [Equation 4]
$SFS_{soiladj}$ = Skin surface area, adjusted for ages 1-6 and adults (mg-yr/kg-event) [Equation 5]
ABS_d = Dermal absorption factor for soil

ABS_{eff} = Oral-to-dermal absorption adjustment factor

$$IF_{soiladj} = \frac{IR_{soil/age1-6} * ED_{age1-6}}{BW_{age1-6}} + \frac{IR_{soil/age7-31} * ED_{age7-31}}{BW_{age7-31}} \quad \text{Equation 4}$$

$IF_{soiladj}$ = Age-adjusted soil ingestion factor (mg-yr/kg-day)
$IR_{soil/age\ 1-6}$ = Ingestion rate of soil age 1 to 6 (mg/day)
$IR_{soil/age\ 7-31}$ = Ingestion rate of soil age 7 to 31 (mg/day)
$ED_{age\ 1-6}$ = Exposure duration during ages 1 to 6 (yr)
$ED_{age\ 7-31}$ = Exposure duration during ages 7 to 31 (yr)
$BW_{age\ 1-6}$ = Body weight from ages 1 to 6 (kg)
$BW_{age\ 7-31}$ = Body weight from ages 7 to 31 (kg)

$$SFS_{soiladj} = \frac{SA_{1-6} * AF_{1-6} * ED_{1-6}}{BW_{1-6}} + \frac{SA_{7-31} * AF_{7-31} * ED_{7-31}}{BW_{7-31}} \quad \text{Equation 5}$$

$SFS_{soiladj}$ = Skin surface area, age adjusted (mg-yr/kg-event)
SA_{1-6} = Skin surface area for ages 1-6 (cm^2)
SA_{7-31} = Skin surface area for ages 7-31 (cm^2)
AF_{1-6} = Soil adherence factor for ages 1-6 (mg/cm^2-event)
AF_{7-31} = Soil adherence factor for ages 7-31 (mg/cm^2-event)
ED_{1-6} = Exposure duration during ages 1-6 (yr)
ED_{7-31} = Exposure duration during ages 7-31 (yr)
BW_{1-6} = Body weight from ages 1-6 (kg)
BW_{7-31} = Body weight from ages 7-31 (kg)

For groundwater:

$$C_{GW} = \frac{CR * AT_c}{F * CSF * \left[(2^a * IF_{wateradj}) + \left(SFS_{wateradj} * ((1/ABS_{eff}) * ET * 0.001 L/cm^3)\right)\right]}$$

C_{GW} = Concentration in soil corresponding to a cancer risk level of 1 x 10^{-6}
CR = Target cancer risk level of 1 x 10^{-6}
AT_c = Averaging time
F = Exposure frequency (days/yr)
CSF = Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
$IF_{wateradj}$ = Ingestion rate, adjusted for ages 1-6 and adults (L-yr/kg-day) [Equation 6]
$SFS_{wateradj}$ = Skin surface area, adjusted for ages 1-6 and adults (cm^3-yr/kg-hr) [Equation 7]
ABS_{eff} = Oral-to-dermal absorption adjustment factor
ET = Exposure time (hours/day)
[a]The $IF_{wateradj}$ is multiplied by two for volatiles only to account for indoor residential exposure via vapor inhalation from tapwater.

$$IF_{wateradj} = \frac{IR_{water/age\,1-6} * ED_{age\,1-6}}{BW_{age\,1-6}} + \frac{IR_{water/age\,7-31} * ED_{age\,7-31}}{BW_{age\,7-31}} \quad \text{Equation 6}$$

$IF_{wateradj}$ = age-adjusted water ingestion factor (L-yr/kg-day)
$IR_{water/age\,1-6}$ = Ingestion rate of water age 1 to 6 (L/day)
$IR_{water/age\,7-31}$ = Ingestion rate of water age 7 to 31 (L/day)
$ED_{age\,1-6}$ = Exposure duration during ages 1 to 6 (yr)
$ED_{age\,7-31}$ = Exposure duration during ages 7 to 31 (yr)
$BW_{age\,1-6}$ = Body weight from ages 1 to 6 (kg)
$BW_{age\,7-31}$ = Body weight from ages 7 to 31 (kg)

$$SFS_{wateradj} = \frac{SA_{1-6} * AF_{1-6} * ED_{1-6}}{BW_{1-6}} + \frac{SA_{7-31} * AF_{7-31} * ED_{7-31}}{BW_{7-31}} \quad \text{Equation 7}$$

$SFS_{wateradj}$ = Skin surface area, adjusted for ages 1-6 and adults (cm^3-yr/kg-hr)
SA_{1-6} = Skin surface area for ages 1-6 (cm^2)
SA_{7-31} = Skin surface area for ages 7-31 (cm^2)
AF_{1-6} = Permeability coefficient (cm/hr) for ages 1-6
AF_{7-31} = Permeability coefficient (cm/hr) for ages 7-31
ED_{1-6} = Exposure duration during ages 1-6 (yr)
ED_{7-31} = Exposure duration during ages 7-31 (yr)
BW_{1-6} = Body weight from ages 1-6 (kg)
BW_{7-31} = Body weight from ages 7-31 (kg)

II. Modifications Based on January 7, 2000 Meeting Discussion

Dioxin

Dioxin risk at the Site is primarily due to dioxin-like PCB congeners, not dioxin congeners, even though soil samples were collected from where dioxin concentrations were expected to be highest. Dioxin and PCB contamination are likely to be detected in the same locations; therefore, dioxin congeners will be remediated when PCBs are remediated. Consequently, this memorandum does not present PRGs for dioxin congeners.

Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)

One PRG is presented for benzo(a)pyrene (B(a)P) rather than individual PRGs for each carcinogenic PAH. Carcinogenic PAH concentrations will be multiplied by the applicable relative potency factor, summed, and compared to the B(a)P PRG.

Polychlorinated Biphenyls (PCBs)

A PRG is presented for "total" PCBs, but not for individual dioxin-like PCB congeners. This PRG reflects PCB cancer risk only, not PCB cancer risk arising from its dioxin-like PCB congener content. However, we did calculate PRGs for the dioxin-like PCB congeners and included these PRGs in our calculation to confirm that cumulative cancer risk at the Site, assuming all PRGs are attained, does not exceed 1E-05. This approach is consistent with USEPA guidance for calculating PCB cancer risk in the forward direction, and it is more conservative than accounting for PCB cancer risk only.

Congener-specific analysis is very expensive, so it would be useful to rely on the total PCB PRG to determine whether dioxin-like PCB congener PRGs are attained. Using weight percent data for dioxin-like PCB congeners at the Site, we calculated total PCB concentrations corresponding to each dioxin-like PCB congener PRG. These total PCB concentrations range from 1.3 mg/kg to 82 mg/kg, except for IUPAC #126, with a corresponding total PCB concentration of 0.16 mg/kg. Assuming a total PCB PRG of approximately 0.5 mg/kg, all dioxin-like congener concentrations will be far below corresponding PRGs following remediation, except for #126. Therefore, it is unlikely that the possible exceedance of congener #126's PRG will result in a cumulative Site risk that is unacceptable. Moreover, adding dioxin-like PCB congener cancer risk and PCB cancer risk probably involves some amount of "double-counting" because the dioxin-like congeners were present in the PCB test material used in the toxicity study used to derive the PCB cancer slope factor. Given that PCBs might cause cancer by multiple mechanisms, it would be difficult to quantify any "double-counting."

"Decoupling" Soil and Groundwater PRGs

During the January meeting, several participants questioned how PRGs might change if soil and groundwater PRGs were "decoupled." In response to this question, we calculated soil PRGs by apportioning NHDES target hazard and risk equally among only soil COPCs. Groundwater PRGs were calculated in the same way. As a result, cumulative hazard and risk across both media is 2 and 2E-05, respectively.

Suggested PRGs

Several participants were concerned that some draft PRGs are too low. In response to this general concern, SHA suggested some alternative PRGs, some higher and some lower than the original draft PRGs, that can be practically attained at the Site:

Soil:
PCBs – 0.5 mg/kg
Bis(2-ethylhexyl)phthalate - 10 mg/kg
Mercury - 0.33 mg/kg (NHDES RCMP background)
Nickel - 24 mg/kg (NHDES RCMP background)

Groundwater:
1,1-Dichloroethane, ethylbenzene, toluene, and 1,1,1-trichloroethane - each 0.005 mg/L

III. Revised Draft PRGs

Table 1 lists revised draft PRGs for the Site. The lowest cumulative PRGs were calculated either for non-cancer hazard to a child resident or for cancer risk to a combined child/adult resident. Consequently, these PRGs are listed in Table 1.

As described in Section I, PRGs are presented in three ways:

1. *Columns 1 and 2*
   New Hampshire target hazard and risk is apportioned equally across all COPCs and both media. With this approach, cumulative hazard and risk at the Site is 1 and 1E-05, respectively. At the bottom of each column, cumulative non-cancer hazard and cancer risk estimates are presented across all COPCs and both contaminated media.

   These are the draft PRGs presented previously; however, they differ slightly from the January 7th handout because we corrected an error in our calculations. Note that our corrections have resulted in nitrate being deleted from the list of COPCs.

2. *Columns 3 and 4*
   New Hampshire target hazard and risk is apportioned equally across all COPCs and both media, except that PRGs suggested by SHA are substituted for a subset of COPCs. Substitution of SHA PRGs increases cumulative non-cancer and cancer risk slightly, but not enough to change cumulative hazard and risk estimates reported to one significant figure. Given sources of uncertainty in the risk assessment, we believe it is not appropriate to report more than one significant figure for these estimates. However, we report three significant figures in the cumulative hazard and risk estimates at the bottom of each column so that it is clear to everyone how SHA's PRGs affect these estimates.

   When considering these PRGs, please note the following:

a) If PRGs for pesticides in groundwater are deleted from the risk calculation (assuming they are false positives), the cumulative risk estimate in column 4 decreases to 1.1E-05.

b) The PRG for chromium is based on the toxicity of hexavalent chromium. The PRG would increase if additional sampling revealed that chromium is not present in this form.

c) Many groundwater PRGs are quite low, sometimes falling below typical laboratory detection limits or below typical background levels for inorganics.

d) Where both cancer and noncancer PRGs are presented for a COPC, clean-up goals are dictated by the lower of the two values. However, for some COPCs, the lower of the two PRGs is either below background concentrations or laboratory detection limits.

e) The soil PRG for arsenic is substantially less than New Hampshire RCMP (and potentially site-specific) background concentration of 12 mg/kg.

3. *Columns 5 and 6*
These columns show PRGs resulting from "decoupling" soil and groundwater. New Hampshire target hazard and risk is apportioned equally across all COPCs within each medium. With this approach, cumulative hazard and risk across both media at the Site is 2 and 2E-05, respectively.

Cancer-based PRGs simply double with decoupling because there is an equal number of carcinogenic COPCs in soil and groundwater (please note that dioxin-like congeners in soil are hidden in Table 1). This is not the case with non-carcinogens.

This approach did not substantially increase groundwater PRGs, and many remain below typical laboratory detection limits.

IV. Putting PCB Cancer Risk into Perspective

PCBs are very important COPCs in soil. They are not COPCs in groundwater. Table 2 shows how the PCB cancer-based PRG is influenced by:

1. the presence of multiple COPCs at the Site; and
2. consideration of dioxin-like PCB congener risk in addition to PCB cancer risk.

As in Table 1, all cancer-based PRGs are based on the RME future resident, combined child and adult. We report more than one significant figure in Table 2 only to illustrate how modifying assumptions changes PRGs and cancer risk estimates. Clearly, some assumptions are not appropriate (e.g., PCBs are not the only COPCs at the Site), but hopefully Table 2 will help put the PCB PRGs in Table 1 into perspective.

V. Conclusions

Columns 3 and 4 in Table 1 show the PRGs that comply with New Hampshire guidance and represent soil concentrations that can likely be attained at the Site. However, the groundwater PRGs remain below some analytical detection limits and New Hampshire Ambient Groundwater Quality Standards (NH AGQS).

Will-ite "behind" by non-detects of groundwater Target in the future?

Table 1
Comparison of PRGs for Soil and Groundwater - Revised
Beede Waste Oil/Cash Energy Site, Plaistow, NH

COPCs for which the Individual Cancer Risk Exceeds 1E-6 or the Hazard Quotient is Greater than 1	COLUMN 1 Target Hazard Index = 1 2 media Hazard apportioned equally [a]	COLUMN 2 Target Cancer Risk = 1E-05 2 media Risk apportioned equally [b]	COLUMN 3 Target Hazard Index = 1 2 media SHA PRGS substituted [c]	COLUMN 4 Target Cancer Risk = 1E-05 2 media SHA PRGS substituted [d]	COLUMN 5 Target Hazard Index = 1 1 medium Hazard apportioned equally [e]	COLUMN 6 Target Cancer Risk = 1E-05 1 medium Risk apportioned equally [f]	ARAR/ TBC [g]
Soil (mg/kg):							
C11-C22 Aromatics	1.6E+02		1.6E+02		6.7E+02		
Benzo(a)pyrene [h]		4.5E-02		4.0E-01		8.9E-02	7.0E-01
bis(2-Ethylhexyl)phthalate		2.3E+01		1.0E+01		4.6E+01	3.9E+01
Polychlorinated Biphenyls	1.2E-01	1.6E-01	5.0E-01	5.0E-01	4.9E-01	3.2E-01	1.0E+00
Arsenic		2.8E-01		2.8E-01		5.6E-01	1.2E+01
Chromium VI (particulates)	6.3E+00		6.3E+00		2.6E+01		1.3E+02
Lead	4.0E+02 [i]		4.0E+02 [i]		4.0E+02 [i]		
Mercury	5.8E-01		3.3E-01		2.4E+00		1.0E+00
Nickel	4.2E+01		2.4E+01		1.6E+02		5.8E+02
Groundwater (mg/L):							
Benzene	2.0E-04	2.4E-04	2.0E-04	2.4E-04	2.6E-04	4.7E-04	5.0E-03
1,1-Dichloroethane	2.5E-02		5.0E-03		3.2E-02		8.1E-02
1,2-Dichloroethane		1.0E-04		1.0E-04		2.0E-04	5.0E-03
1,1-Dichloroethene		1.5E-05		1.5E-05		3.0E-05	7.0E-03
1,2-Dichloroethene (cis)	2.4E-03		2.4E-03		3.2E-03		7.0E-02
Ethylbenzene	7.6E-03		5.0E-03		9.9E-03		7.0E-01
Methylene Chloride	1.5E-02	1.2E-03	1.5E-02	1.2E-03	1.9E-02	2.5E-03	5.0E-03
Toluene	1.5E-02		5.0E-03		2.0E-02		1.0E+00
1,1,1-Trichloroethane	4.8E-03		5.0E-03		6.3E-03		2.0E-01
1,1,2,2-Tetrachloroethane		4.6E-05		4.6E-05		9.2E-05	1.7E-04
Tetrachloroethene		7.9E-05		7.9E-05		1.6E-04	5.0E-03
Trichloroethene		4.8E-04		4.8E-04		9.5E-04	5.0E-03
Vinyl Chloride	1.2E-03	3.7E-06	1.2E-03	3.7E-06	1.6E-03	7.4E-06	2.0E-03
C9-C10 Aromatics	1.5E-02		1.5E-02		2.0E-02		
C11-C22 Aromatics	2.3E-03		2.3E-03		3.0E-03		
Naphthalene	7.6E-03		7.6E-03		9.9E-03		2.0E-02
Aldrin		1.1E-06		1.1E-06		2.2E-06	4.0E-05
alpha-BHC		1.2E-06		1.2E-06		2.4E-06	6.0E-06
gamma-BHC (Lindane)		5.9E-06		5.9E-06		1.2E-05	2.0E-05
Dieldrin		1.1E-06		1.1E-06		2.1E-06	2.0E-06
Heptachlor		3.9E-06		3.9E-06		7.8E-06	4.0E-04
Heptachlor Epoxide		1.9E-06		1.9E-06		3.9E-06	2.0E-04
Antimony	1.9E-04		1.9E-04		2.5E-04		6.00E-03
Arsenic	1.5E-04	1.3E-05	1.5E-04	1.3E-05	1.9E-04	2.5E-05	5.0E-02
Cadmium (Water)	2.3E-04		2.3E-04		3.0E-04		5.00E-03
Chromium VI (aerosols)	7.8E-04		7.8E-04		1.0E-03		1.0E-01
Manganese	2.2E-02		2.2E-02		2.8E-02		
Cumulative Hazard/Risk Across All COPCs and Both Contaminated Media	1.01	9.99E-06	1.04	1.31E-05	2.00	1.99E-05	

[a] Non-cancer PRGs are based on the future child resident RME exposure scenario with soil PRGs based on the oral and dermal pathways combined and groundwater PRGs based on the oral, dermal and inhalation pathways combined. PRGs are cumulative (incoporating all compounds in both media).

[b] Cancer PRGs are based on the future resident RME exposure scenario which combines the child and adult resident. Soil PRGs are based on the oral and dermal pathways and groundwater PRGs are based on the oral, dermal and inhalation pathways combined. PRGs are cumulative (incorporating all compounds in both media).

[c] Non-cancer PRGs are based on the future child resident RME exposure scenario, and are cumulative (incorporating all compounds in both media). Values in bold are proposed changes to cleanup levels from SHA based on the distribution and concentration of Site data.

[d] Cancer PRGs are based on the future resident RME exposure scenario which combines the child and adult resident, and are cumulative (incorporating all compounds in both media). Values in bold are proposed changes to cleanup levels from SHA based on the distribution and concentration of Site data.

[e] Non-cancer PRGs are based on the future child resident RME exposure scenario, assuming that either site groundwater or soil is the only medium of concern.

[f] Cancer PRGs are based on the future resident RME exposure scenario which combines the child and adult resident, assuming either site groundwater or soil is the only medium of concern.

[g] ARARs (applicable or relevant and appropriate requirement) for groundwater are the NH AGQSs. TBCs (to be considered) for soil are the NH S-1 standards.

[h] All carcinogenic PAH concentrations will be multiplied by the applicable relative potency factor, summed, and compared to the B(a)P PRG.

[i] The Soil PRG for lead is based on the IEUBK model.

Table 2.
PCB PRGs for Soil Under Several Scenarios (assuming a target cancer risk = 1E-05)
Beede Waste Oil/Cash Energy Site, Plaistow, NH

	Assumptions	*Soil PRG for PCBs (mg/kg)*
Scenario 1	1. The only COPCs at the Site are PCBs in soil 2. Cancer risk from dioxin-like PCB congeners is not considered 3. Substituting the PCB PRG into forward risk equations results in a cumulative cancer risk of 1.00 E-05	4.81
Scenario 2	1. The only COPCs at the Site are PCBs in soil 2. In calculating PRGs, the target cancer risk is apportioned equally among PCBs and all dioxin-like PCB congeners 3. Substituting the PCB PRG and dioxin-like congener PRGs into forward risk equations results in a cumulative cancer risk of 1.02 E-05	0.409
Scenario 3	1. The full list of soil and groundwater COPCs are present at the Site 2. In calculating PRGs, the target cancer risk is apportioned equally among all COPCs, *excluding dioxin-like PCB congeners* 3. Substituting COPC PRGs into forward risk equations results in a cumulative cancer risk of 1.00 E-05	0.253
Scenario 4 **(Column 2 from Table 1)**	1. The full list of soil and groundwater COPCs are present at the Site 2. In calculating PRGs, the target cancer risk is apportioned equally among all COPCs, *including dioxin-like PCB congeners* 3. Substituting PRGs for all COPCs into forward risk equations results in a cumulative cancer risk of 9.99 E-06	0.16
Scenario 5 **(Column 4 from Table 1)**	1. The full list of soil and groundwater COPCs are present at the Site 2. In calculating PRGs, the target cancer risk is apportioned equally among all COPCs, *including dioxin-like PCB congeners* 3. Some of these PRGs are then replaced with SHA's suggested PRGs (these replacement PRGs are shown in boldface in Table 1) 4. Substituting PRGs for all COPCs into forward risk equations results in a cumulative cancer risk of 1.31 E-05	0.5